Co-organizers: J. Norris, G. Barbiellini, B. Dingus, G. Share, R. Svensson

The 30+ member GRB-SF Science Team – all those who have expressed interest – spans the LAT team, GBM team, SSC, and the community.

"Core Software Group" includes: S. Bansal, J. Bonnell, J. Cohen-Tanugi, M. Kippen, F. Longo, N. Omodei, J. Scargle, J. McEnery, J. Norris

EGRET/BATSE cross-calibration effort: B. Dingus, R. Preece

Combined LAT+GBM GRB analysis tools effort: D. Band

GRB-SF Team: Current Focus

- ✓ Simulations: Construct synthetic GRBs spanning LAT+GBM energy range.
- ✓ LAT trigger: Optimize a realizable on-board GRB trigger.
- ✓ GRB physical model: Develop for LAT science analysis.
- ✓ LAT science analysis tools: advise on scope and design.
- ☺ LAT alert: Determine practical contents of the LAT GRB alert message.
- ☺ GBM-S/C-LAT communications: Study how GBM information can help identify LAT GRB photons on-board S/C.

GRB Simulations: Signal

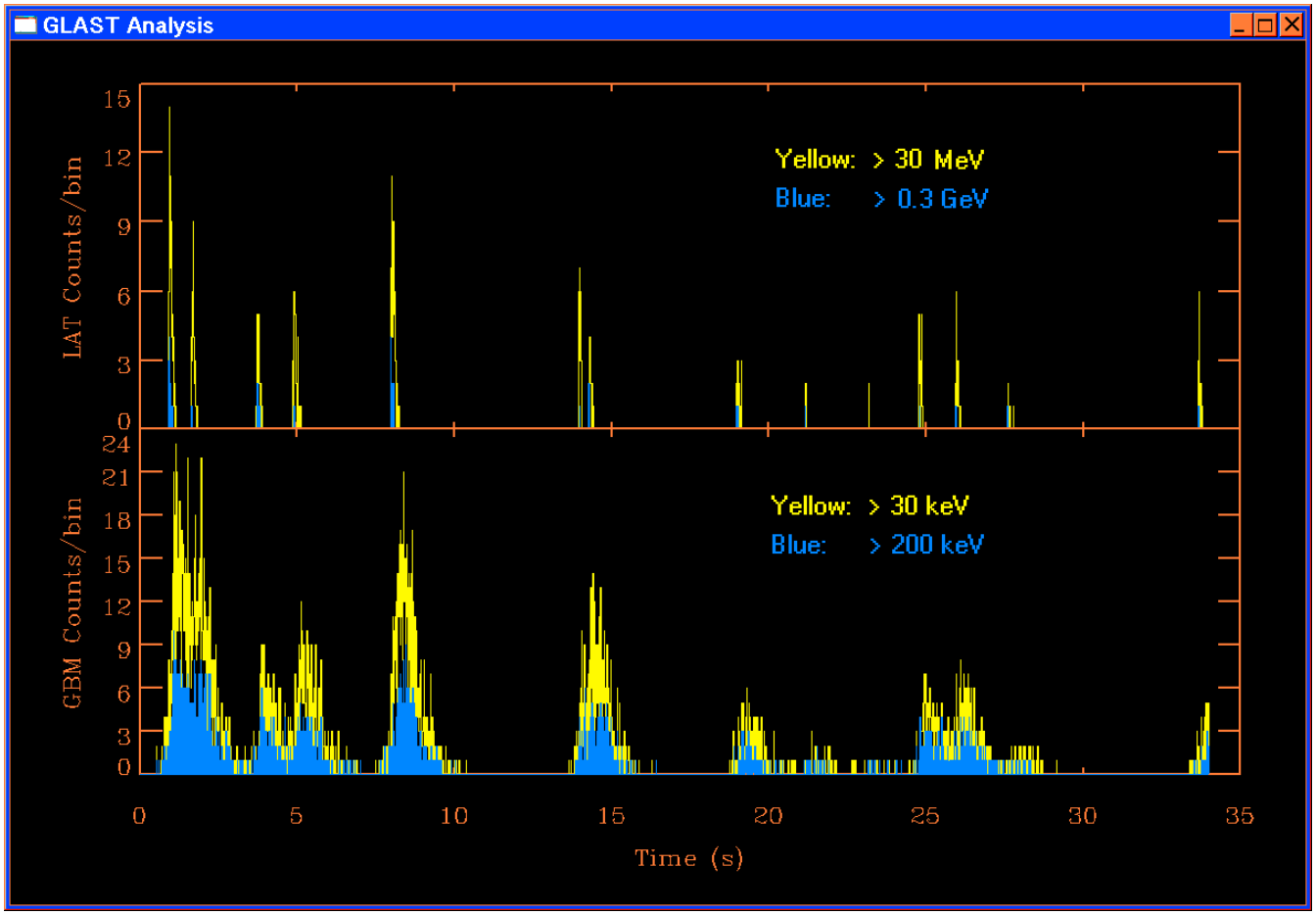
- ✓ **GRB signal:**
  - **GRBsim (N. Omodei) – based on physics of colliding shells**
  - **GRBmaker (S. Bansal: C++, J. Norris: IDL) – based on empirical distributions (BATSE), and extrapolation to LAT energies:**
    - ➢ **Peak Fluxes**
    - ➢ **Durations**
    - ➢ **Pulse Widths (E)**
    - ➢ **Spectral Power-laws**

    } "necessary & ~ sufficient" for trigger studies

    LAT profiles – single power-law spectra
    GBM profiles – broken power-law spectra
  - **We need the GBM information to study how GBM *might* help identify LAT photons on-board, or in ground quick-look data.**

    We also need to compare
    - ➢ **LAT and GBM trigger efficiencies, and**
    - ➢ **LAT and GBM localization accuracies.**

Atypical (They're all different) GRB Simulation



Dur = 34 s

F_p = 1.5 cm^{-2} s^{-1}

□ = 1.15

□ = 1.99

Epeak = 245 keV

Npulses = 17

nLATphots = 584

nGBMphots = 5607

GBM: Area □ 3 NaI detectors

GRB Simulations: Background

- ☺ Use on-board track recon for GRB photons (J. Cohen-Tanugi)
- ✓ Detect the GRB signal, processing through *GLEAM* (J. Bonnell)
- ✓ Add to detected GRB signal … the LAT on-board background:
  - After applicable on-board filters realize ~ 30 Hz background rate
  - Choose energies from on-board decimated background-mix spectrum (S. Ritz)
  - Choose directions of particles from detected distributions.
- ☺ Do many set of runs, varying: background rate and form (constant, or 1st order polynomial), burst selection, event window. (Team)

Bottom line philosophy: Separating the detection of signal and background in this way is expedient, and the resulting accuracy is commensurate with (or better than) the GRB simulation.

GRB Sims: What Things are Missing

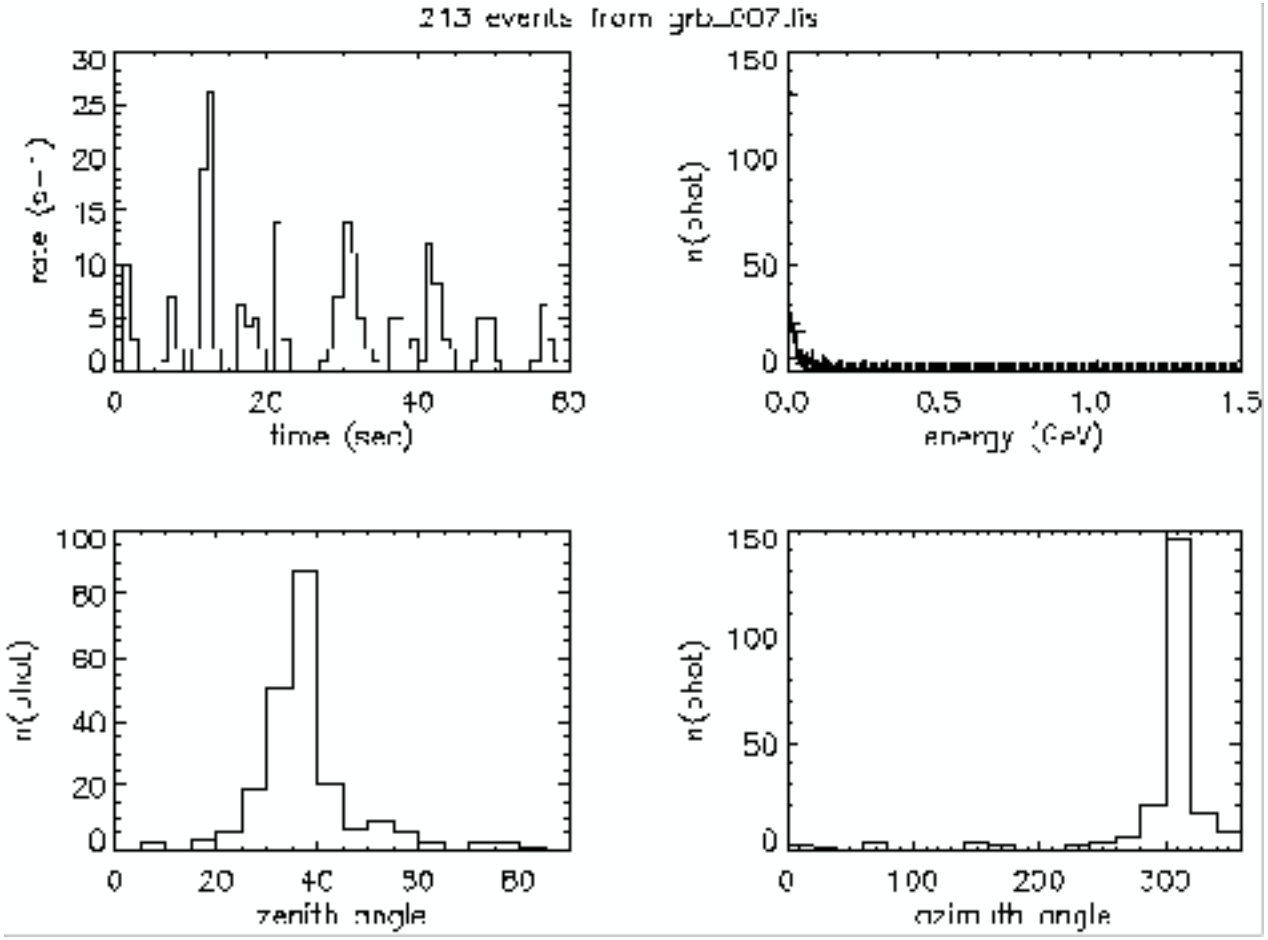
☺ **Future improvements in GRBmaker (empirical simulator):**

(S. Bansal, J. McEnery, B. Dingus, R. Preece, J. Norris)

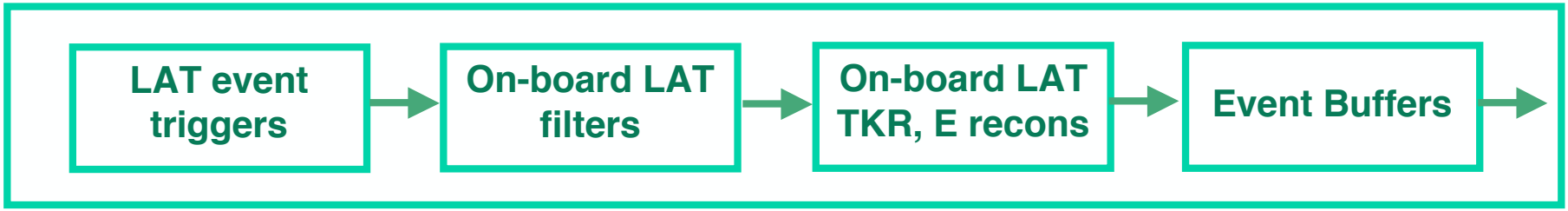
- Pulse clustering
- Refined pulse-width energy dependence
- Spectral softening across burst duration
- EGRET/BATSE cross-calibration of power-law index distribution
- Duration and E_{peak} dependences on peak flux
- Redshift-dependent attenuation by IR background
- Energy- & Redshift-dependent temporal dispersion (QG theory)

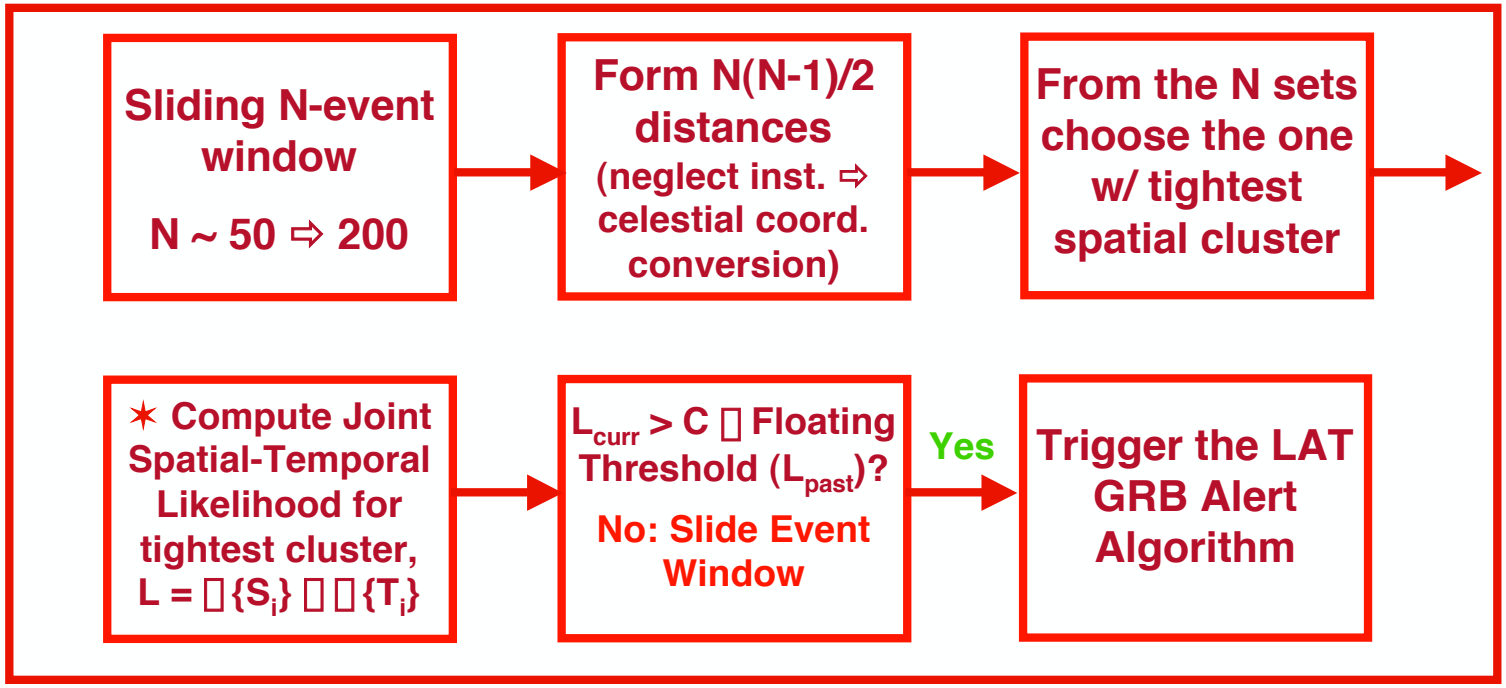
— All refinements pertain (mostly) to science investigations.

GRBmaker: Testing



"Placeholder" LAT GRB Trigger





✶ Various spatial, temporal (Bayesian Blocks) refinements possible.

Some LAT GRB Alert Trade Studies

☺ How to realize best, prompt LAT GRB localization:

- Use many LAT photons with TKR recon on-board, OR

  Fewer (but high E) photons telemetered to ground in alert message, and run "full-up" TKR recon at MOC ?

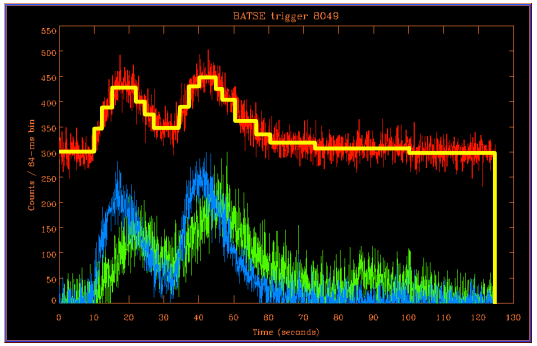
☺ What kind of GBM information might be used to help identify LAT photons on-board:

- Use some measure of spectral hardness + count rates, OR

  Specific timing information about pulse structure positions ?

  Like Bayesian Blocks

➢ J. Scargle,
S.J.S.U.



☺ Definition of LAT alert parms (spectral, temporal, spatial)

GRB Physical Model

The Theoretical model

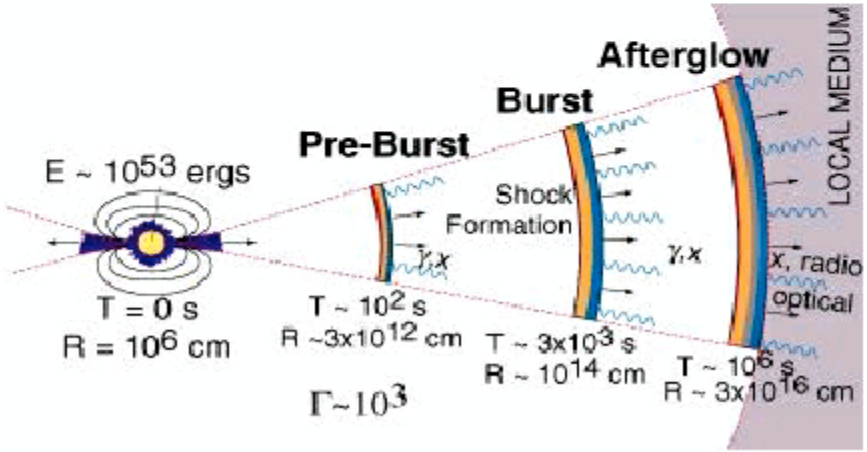
We have started from a plausible astrophysical source model (Fireball Model) that describes the temporal behaviour of a typical Gamma Ray Burst

The central engine emits shells with different Lorentz Factor.

The shells collide -> formation of shocks wave inside the shell`s material

The shock accelerate the electrons that emits by synchrotron (presence of MF).

The high energy emission is provide by the Compton Scattering



GRB Processing: Summary

- ✓ **A GRB core simulation group has been formed, is seriously pursuing practical answers to LAT trigger, alert and localization issues, and will interact with flight SW teams.**
- ✓ **The two (C++) GRB simulation packages (one empirical, one physics based) make synthetic GRBs – spanning the GBM+LAT energy regime – suitable for addressing the issues.**
- ✓ **A (5-dimensionally) adjustable strawman LAT GRB trigger algorithm (C++) is being exercised in the *Gleam* context.**
- ☺ **A plan for defining and optimizing the contents of the LAT GRB alert message is in place – 6 to 9 months for recommendation.**
- ☺ **A related study is planned to determine whether the most rapid, accurate LAT GRB localizations should be generated on-board, or at the MOC – 9 to 12 months for recommendation.**